Reflected heat warms Earth, man, and moose alike

by Ed Berg

A moose will typically seek thermal cover in the forest. Pictured here at Skilak.

By any standards this is a strange winter in Alaska. Fairbanks temperatures are about 18°F above normal this winter, and Anchorage is up about 10-11°F. My black Lab is shedding, garden perennials in Homer are sprouting, and the Refuge still hasn't been opened for snowmachining, due to lack of sufficient snow. What is going on!?

Meteorologists report that the Aleutian Low Pressure zone is lower than normal, and this has held cloud cover over Alaska since early in November, with few breaks. Due to the clouds we have missed several good aurora displays, a meteor shower, a Christmas solar eclipse, as well as the cold weather.

Clouds make a great blanket because they reflect infrared radiation (i.e., radiant heat) back to the earth. Infrared is invisible to the naked human eye, so it's easy to overlook its importance. We all enjoy direct infrared sources like woodstoves and heat lamps, but have you ever tried to sense reflected infrared heat? Here is a simple experiment, for kids of all ages. Stand in the middle of a room with a large thermopane window or two. Stretch out your arms together with your palms facing a wall. Shut your eyes and concentrate on your palms; think of them as heat sensors. Now turn slowly and sweep your heat sensors past a window. You should feel a slight cooling of the palms. Sweep further to another wall and feel the heat return.

The real test comes when you have someone spin you around blind-folded, and you can still detect the windows even when you have lost your orientation to the room. The principle here is that your body radiates infrared rays; these rays are reflected and re-radiated from the wall, and returned to your palms where you sense them as heat. When you aim your rays at a window, most of them pass through the window glass and are lost to outer space (the sky) or scattered by vegetation, other buildings, etc., beyond the window.

It is possible to install transparent heat-reflective films on window glass, which reduce the infrared transmission (i.e., heat loss) through the window. These films actually work, and you can feel the difference with your palms if you compare windows with and without the film side-by-side. A room with reflective-film coated windows feels warmer, even at a lower air temperature, because the reflected heat warms your skin. The gold-windowed glass office buildings in Anchorage have taken this concept to near max; full max would be windowless rooms lined with shiny tinfoil, if one didn't mind the aesthetics!

Wild animals, especially large ones, know well the virtues of reflected heat. Moose for example seek "thermal cover" in the forest, where trees reflect back the moose's infrared heat, as well as re-radiate heat gained from the sun and sky. If we quantify heat energy in units of "Snickers bars" (at 290 nutritional calories per Snickers bar), a 1000 lb. moose on a calm night (2 mph breeze) will lose the equivalent heat of 1.57 Snickers bar per hour, or about 22 Snickers bars per 14 hour night. If the moose moves into the woods, it will lose only 0.31 Snickers bars/hour or 4.4 Snickers bars per night. Thermal cover thus cuts radiant heat loss for the moose by 80%. Imagine having your winter fuel bill cut by 80%!

A good burrow provides a three-dimensional heat reflector for burrowing critters. A burrow also reduces heat loss from wind (convection) and evaporation, and if the animal is resting on an insulating bed of grass or leaves, this reduces heat loss by conduction to the borrow floor.

It is possible, however, to overdue a good thing. Just as clouds (composed of water vapor) reflect back the Earth's heat and make our winter warmer, the in-

visible carbon dioxide (CO_2) gas in the atmosphere reflects back heat and warms both the ground and the air. As more CO_2 is added from fossil fuel consumption (beyond natural sources like respiration, volcanos, forest fires, etc.), the atmosphere is becoming a better reflector and we are experiencing global warming. In all fairness, however, we probably shouldn't blame this particular warm winter on global warming. Strong Aleutian Lows (and cloudy winters) come and go over the years and decades, but long-term warming trend is hard to ignore, especially in the northern latitudes. Winters in Alaska have warmed over the last century, and not everyone would say that's a bad thing.

Ed Berg has been the ecologist at the Kenai National Wildlife Refuge since 1993. Information about Snickers bars and moose is from the excellent book "Winter: an Ecological Handbook" by James Halfpenny and Roy Ozanne, 1989, Johnson Books publisher. For more information about the Refuge, visit the headquarters on Ski Hill Road in Soldotna, call 262-7021 or see the website at http://www.fws.gov/refuge/kenai/.